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Review Article
Nigerian Folklore Medicinal Plants with Potential Antifertility Activity in Males: A Scientific Appraisal

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Abstract

In spite of the many achievements in health care delivery in the current century as evidenced by the rapid progress and expansion of orthodox medicine, people in Nigeria like in most of the developing countries lack regular access to essential medicines. For these people, faith in and popularity of traditional methods have not decreased because modern medicine is unlikely to be a tenable treatment alternative primarily because of its high cost. The cost of modern medicine is constantly increasing with improvements in modern health technology and in many cases is inappropriate to the immediate needs of people in developing and underdeveloped countries. On the other hand, medicinal herbs are widely available and affordable, even in remote areas. In addition, consumers believe that herbal medicines are safe because they are "Natural". The constant resort to medical herbalism has however, thrown up certain health challenges arising from the side and unwanted effects of these herbs on the human anatomy and physiology. One such health condition is male infertility or sub-fertility as a result of the effect of medicinal herbs on the male reproductive organs. This review attempts to document those nigerian medicinal plants that possess the potentials to reduce male fertility particularly as demonstrated from the results of basic and allied medical sciences research and published in the peer reviewed scientific literature.

Key words: Medicinal plants, infertility, male, therapeutic/folkloric use, leydig cells, methanolic extracts

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INTRODUCTION

Complementary and Alternative Medicine (CAM) is defined as "A group of diverse medical and health care systems, practices and products that are not presently considered to be part of conventional medicine". It interprets "Complementary" medicine as being used together with conventional medicine, whereas "Alternative" medicine is used in place of conventional medicine (Hoffman and Fox, 2006).

The CAM therapies are classified into four categories or domains (May, 2011):

- Biologically-based practices
- Energy therapies
- Manipulative and body-based methods and
- Mind-body medicine

Biologically based therapies in CAM use substances found in nature, such as herbs, foods and vitamins. Some examples include dietary supplements, herbal products and the use of other so-called natural but as yet scientifically unproven therapies (for example, using shark cartilage to treat cancer) (Ruggie, 2004; Shealy and Dawson, 2006).

Medical herbalism or simply, herbalism or herbology, is "The study of herbs and their medicinal uses". This definition can be extended to include the cultivation, collection or dispensing of aromatic plants, especially those considered to have medicinal properties.

Other terms substituted for medical herbalism, include herbal or botanical medicine or phytotherapy, previously defined as "The use of plant materials to prevent and treat ill health or promote wellness" (Bekalo *et al*., 2009).

Medicinal plants play a crucial role in health care needs of people around the world especially in developing countries (Rao *et al*., 2004; Bekalo *et al*., 2009). About 80% of the populations of most developing countries still depend on the use of traditional medicine derived from plants (Cunningham, 1993).

The African continent has a long history with the use of plants for medicinal purposes (Metz, 1991). Traditional medicine was the only source of health care in Nigeria in historical times.

Orthodox medicine was not formally introduced into Nigeria until 1860s when Sacred Heart Hospital was established by the Roman Catholic Missionaries in Abeokuta (Bekalo *et al*., 2009).

In the past two decades, there has been a global resurgence of interest in traditional medicine for the treatment of ailments that defile orthodox medicine principally because many diseases have defiled or developed resistance to conventional drugs as well as a health system closer to the rural poor. As a result of this renaissance in unorthodox medicine, a lot of interest and attention have been drawn to the curative claims and norms (ethics) of herbal plants in different parts of the globe especially Africa and Asia.

Characteristics of herbal medicine: Herbal medicine has some characteristics that make them unique and different from synthetic drugs (Calixto, 2000). These include:

- The active principle is frequently unknown
- The availability and quality control are frequently problematic
- Standardization, stability and quality control are feasible but not easy
- They have a wide range of therapeutic use and are suitable for chronic treatments
- Well-controlled double blind clinical and toxicological studies to prove their efficacy and safety are rare when compared with synthetic drugs but well-controlled randomized clinical trial revealed they do exist
- They are cheaper than synthetic drugs

The medical systems in developing countries involve both traditional herbal systems and orthodox medicine. Due to the economic predicament of these countries, the people resort to the traditional herbal system for primary health care. In Africa, particularly West Africa, new drugs are not often affordable thus up to 80% of the population use medicinal plants as remedies (Kirby, 1996; Hostettmann and Marston, 2002). World bank data on African development indicators 2003 revealed that the ratio of medical doctors to total population for 1990-2000 in Nigeria was 1:5208. This condition and the fact that international commercial orthodox medicines are becoming increasingly out of reach for most Nigerians have contributed to the dependence of a large percentage of the Nigerian people on local herbal medicine (Sofowora, 1992).

Treatment offered by traditional herbal healers at the primary health care leveled has greatly sustained the Nigerian Society before and after colonization.

IMPORTANCE OF MEDICAL HERBALISM IN AFRICA

World Health Organization (WHO) estimates that around 80% of the population in Africa-use traditional medicines. About 85% of traditional medicine involves use of plant

extracts (Farnsworth and Soejarto, 1985). This would imply that the reliance on herbal medicine is immense. To appreciate the extent of this dependence, it is estimated that in Sub-Saharan Africa there is one traditional healer for every 500 people, whereas there is only one medical doctor for every 40,000 people. Therefore the importance of herbal medicines in the life of Africans cannot be overemphasized. The re-insurgence of interest of herbal medicines in Africa is backed by several reasons namely, the increasingly expensive and unavailability of orthodox drugs to average income earners (Sofowora, 1992). Another reason is that many ailments are developing resistance to orthodox drugs, for instance, the increasing resistance of malaria parasites to chloroquine which is the cheapest and the most commonly used drugs for treating malaria in Nigeria (Odugbemi *et al*., 2007). Bacterial resistance to antibiotics is another classical example. The inability of Western orthodox medicine to provide cure for some diseases and infections (e.g., HIV/AIDS) is a possible reason also. The ascendancy of the human immune deficiency virus has spurred intensive investigation into plant derivatives which may be effective especially for use in developing and underdeveloped nations. The little or no side effects with use of herbal medicines are other factors often stated in favour of herbalism.

Demand for herbal medicine: For years, public interest has increased for natural therapies (mainly herbal medicine) all over the world including Africa (Grunwald, 1995; Robbers *et al*., 1996; Blumenthal, 1999). According to Grunwald (1995), there are several factors that lead to the preference and growth of phytotherapeutic market worldwide and they include:

- Preference of consumers for natural therapies
- Great interest in alternative medicine
- The belief that herbal medicine is devoid of side effect since millions of people all over the world have been using herbal medicine for thousands of years
- The belief that herbal medicine is used for the treatment of certain diseases where conventional medicine fails
- Improvement in the quality, proof of efficacy and safety of herbal medicine and
- High cost of synthetic drugs

EFFECTS OF HERBAL MEDICINES ON MALE REPRODUCTIVE ANATOMY AND PHYSIOLOGY

Male reproduction anatomy is a complex structure that involves the testes, epididymis, accessory sex glands and associated hormones. Testes perform two highly organized and intricate functions, called spermatogenesis and steroidogenesis, which are crucial for the perpetuation of life. Spermatogenesis, a highly dynamic and synchronized process, takes place within the seminiferous tubules of the testis with the support of somatic Sertoli cells, leading to the formation of mature spermatozoa from undifferentiated stem cells (Hess and de Franca, 2008). The interstitial compartment, which comprises leydig cells, is the site of steroidogenesis in the testis (Osinowo, 2006).

Several plants are reported to enhance reproductive processes in laboratory animal models. This has been severally demonstrated in our laboratory. This include the findings that; grapefruit seed extract demonstrates profertility effects in male rats (Saalu *et al*., 2008, 2010a, b), extract of *Sesame radiatum* enhances fertility in male *Sprague dawley* rats (Ukwenya *et al*., 2008), *Moringa oleifera* lamark (drumstick) leaf extract modulates testicular toxicity in rats (Saalu *et al*., 2011), aqueous extract of date (*Phoenix dactylifera*) protects testis (Akunna *et al*., 2012), *Laurus nobilis* preserves testicular functions in crytorchid rat (Akunna *et al*., 2012), stem bark extract of *Enantia chlorantha* has testiculo-protective effect on Lead-induced toxicity in adult wistar rat (Oyewopo *et al*., 2012), bitter leaf has a modulating role on spermatogenic and steroidogenesis functions of the rat testis (Saalu *et al*., 2013), *Cissus populnea* extract and *Jatropha curcas* extract has ameliorating effect on the rat testis (Oyewopo *et al*., 2014) and *Croton zambesicus* leaf extract has ameliorating capabilities on the testis of rats exposed to pyrethroid-based insecticide (Akunna *et al*., 2014).

However, many basic science researches have shown several medicinal plants that hinder testicular functions.

The aim of this review is to collate all available data on nigerian medical plants with antifertility effects reported in the scientific literature.

The list of potential male antifertility Nigerian medicinal plants is presented with their photo, scientific name, common name and the local nigerian names of the country in which they are available are indicated. The description of methods used in the experiment model animals and the effect of antifertility, doses, duration of exposure, the part used, the folkloric usage and phytochemical composition are also included. Plants which did not show any significant antifertility effect were not included.

A total of 40 medical plants are reported in this review as having different antifertility activities. The collected information are given below and also summarized in Table 1 and 2.

Table 1: Medicinal plants in Nigeria with potential antifertility pontentials

Scientific name	Common name	Local Nigerian name	Therapeutic/folkloric use	Part used
Abrus precatorius	Jumble beads	Oju ologbo (Yoruba), Damar Zaya (Hausa) and Anya Mumu (Igbo)	Cough, convulsion, anemia, aphrodisiac, ulcer	Root, leaves and seeds
Acacia auriculae formis		Kasisa eleti (Yoruba)	Astringent	Stem bark
Acacia concinna	Velvet bean	Yerepe (Yoruba)	Ant-dandruff, skin diseases	Stem bark
Albizzia lebbeck	Siris	Igbagbo (Yoruba) and Esheye shege (Bini)	Diarrhea, low back pain	Pod, bark
Allamanda cathattica	Golden Trumpet	Orogbo-erin (Yoruba) and Izeni (Edo)	Cough, waist pain, yellow fever	Leaf
Allium sativum	Garlic	Ayuu (Yoruba), Tafarnawa (Hausa) and Ayo (Igbo)	Stroke, eye pains	Bulb
Aloe barbaderisis	Aloe Vera	Alon Erin (Yoruba), Ibube agu (Igbo) and Tinya (Hausa)	Cancer eczema, wounds, acne, ulcer, impotence	Root and leaf
Ananas comosus	Pineapple	Ogede-oyibo (youruba), Akwu-oyibo (Igbo), Mbuer u buter (Tiv) and Eyop mbakara (Efik)	Purgative, stomach upset	Unripe fruit
Anethem graveolens	Soya	Alasisede (Yoruba)	Headache, malaria	Leaf
Aspillia africana	Bush marigold Friend of pepper	Yun yun (Yoruba), Kalankwa (Hausa) and Urangila (Igbo)	Stop bleeding, promotes healing, antimalarials	Leaf
Azadirachta indica	Neem	Dogonyaro (Hausa)/(Yoruba)/(Edo)/(Tiv)	Malaria, chicken pox, Antifungal, Antibacterial, Antihelminths	Leaf
Bambusa arundinaccea	Common bamboo	Gora (hausa), Kewal, kewe (fulfude), Songough (Tiv), Otosi (ibo)	Stomach upset, antimalarial	Shoot (tender)
Barleria prionitis	Porcupine flower	Sinkinmini (Yoruba)	Fever, Anti-malarial	Root
Calotropis procera	Qak	Bomubomu (yoruba)	Measles, diaphoretic emetic, asthma, antipyretic	Root
Canabis sativa	Ganja, indian hemp	Igbo (Yoruba), Nwonkaka (Igbo) and Ikya (Tiv)	Mood stimulant, sedative	Root and leaf
Carica papaya	Pawpaw	Ibepe (Yoruba), Gwanda (Hausa), Okwuru bekoe (Igbo) and Mpuer (Tiv)	Constipation, stomach upset	Fruit and leaf
Celastrus paniculatus	Intellect tree	Rimi (Hausa), Vambe (Tlv)	Convulsion, headache	Seed
Chromolaena odoratum	Siam weed	Akintola/Awolowo (Yoruba), Obiarakaka (Igbo) and Ebe Awolowo (Edo)	Stops bleeding, heals wounds, indigestion, stomach upset	Leaf
Citrullus cobcynthis	Bitter gourd Wild gourd	Kwantowa (Hausa) and Egwusi (Igbo)	Laxative, sexually transmitted diseases, Epilepsy	Fruit
Curcuma longa	tumeric	Ata-Ile Pupa (Yoruba)	Heart ,liver and chest problems, fever ringworm	Entire part
Daucus carota	Carot	Karoti (Hausa)	Antiinflammatory, Anti rheumatic, fever	Tuber
Fadogia agrestis	Black magic	Bakin gagai (Hausa)	Black aphrodisiac	Stem
Gossypium herbaceum	Cotton	Auduga (Hausa), Owu (Igede), Ikro afor (Igbo) and Igi-ora (Yoruba)	Wound dressing, general infertility, ailments	Seed/leaf
Leptademia anastata	Tears	Yaadiya (Hausa)	Cancer, antimicrobials	Leaf and root
Mormordica charanta	African cucumber	Daddagu (Hausa), Ejinrin (Yoruba), Alaban adene (Ibo) and Dagdaye (Kanuri)	Asthma, cough, liver problems	Leaf
Mucuna urens	Cow itch plant Velvet bean	Ewe-ina , yerepe (Yoruba) and Agba Ohia (Igbo)	Blood tonic, intestinal worms, genito-urinary disease	Fruit and Leaf
Nicotiana tabacum	Tobacco	Ewe (Yoruba), Taba (Hausa), Anwere (Igbo), Itaba (Edo), and Taav (Tiv)	Convulsion, Epilepsy, toothache, ringworm, cold, ulcers	Leaf
Piper nigrun	Black pepper	Iyere (Yoruba), Uzize (Igbo) and Masooroo (Hausa)	Constipation, anti-inflammatory	Leaf
Pterocarpus santalinus	Red sandal	Gbengbe (Yoruba), Gunduruu (Hausa) and Nturukpa (Igede)	Skin diseases, antipyretic, antidiarrhoea	Leaf
Ricinus conmunis	Castor bean	Lara pupa (Yoruba) and Kulakula Nkpikpi (Hausa)	Veneral diseases	Seed and Root
Syzygium aromaticum	Clove	Kanum fari (Hausa)	Cough and catarrh	Flower buds
Syzygium cuminii	Skeels	Ori (Yoruba) and Malmoo (Hausa)	Purgative	Bark
Tecoma stans	Yellow bells	Awun (Yoruba) and Ukhu (Bini)	Antimalarial	Fruits
Terminalia superba	Black limba	Afara (Yoruba) and Baushe (Hausa)	Antimalarial	Leaf
Thevetia peruviana	Yellow oleandar Suicide tree	Olomojo (Yoruba)	Antimeasles, anti-diabetics	Bark
Tinospora Cordifolia	Hearth leaves	Epaikum (Yoruba)	Anti-inflammatory	Stem
Trigonella foenum-graecum	Wild yam	Osanwene (Yoruba), lemu (Hausa) and Olofa-nta (Igbo)	Antimalarial, chest diseases, abdominal upset	Seeds
Vigna angiculata	Cowpea	Owi-ahun (Yoruba) and Wakia-tunka (Hausa)	2	Leaf and Stem
Zizyphas Mauritania	Indian plum	Magarya (Hausa)	Antimalarial, abdominal upset	Bark

Table 2: Basic medical science research demonstration of the male anti-fertility potentials of Nigerian medicinal plants

Scientific name	Part used	Solvent	Dosage	Duration	Phytochemical	Animal model	Research findings	References
Abrus precatorium	Seed	Aqueous	400, 800 and 1600 mg kg^{-1} b.wt. day^{-1}	18 days	Alkaloids, steroids, anthocyannins fix oils	Rat	Testicular degeneration	Adedapo *et al.* (2007)
		Ethanol	100 mg kg^{-1} b.wt. day^{-1}	60 days		Rat	Reduced sperm motility	Rao (1987)
		Methanol	20 mg mL^{-1}			Human sperm	Reduced sperm motility	Ratnasooriya *et al.* (1991)
		Methanol	20 and 40 mg kg^{-1} day^{-1}	45 days		Mice	Reduced sperm count, motility and viability	Sinha and Mathur (1990)
		Aqueous	50 mg kg^{-1} day^{-1}	30 days		Rat	Reduced sperm count, Reduced level of testosterone	Bhatt *et al.* (2007) and Gigani *et al.* (2012)
Albezzia lebbeck	Bark	Methanol	50, 100 and 200 mg kg^{-1} day^{-1}	60 days	Saponins	Rat	Spermatogenic arrest with reduced sperm count and sperm motility	Gupta *et al.* (2004)
							Decrease in weight of testis	Gupta *et al.* (2005)
Acacia auriculae formis	Bark	Triterpene	20 and 50 mg kg^{-1} day^{-1}	40 days	Saponins	Rat	Sperm immobilizing effect	Pakrashi *et al.* (1991)
Allamanda cathartica	Leaf	Acqueous	150 mg kg^{-1} day^{-1}	14, 28 and 42 days	Alkaloids Saponins	Mice	Reduced sperm count	Singh and Singh (2008)
Allium sativum	Bulb	Aqueous	0.25 g mL^{-1} 0.5 g mL^{-1}	-	Alkaloids Saponins	Human ejaculate sperm	Instant immobilization of epididymal sperm	Chakrabarti *et al.* (2003)
		Dry powder	20 mg and 50 mg kg^{-1} day^{-1}	60 days		Rat	Anti-spermatogenic and anti-androgenic activity	Hammami *et al.* (2008, 2009)
		Aqueous	500 and 1000 mg kg^{-1} day^{-1}	60 days		Rat	Reduced sperm count Reduced sperm motility	Omotoso *et al.* (2010)
Aloe barbadensis	Leaf	50% Ethanol	70 and 100 mg kg^{-1} day^{-1}	56 days	Steroids Alkaloids Tanins	Dog	Antiandrogenic activity	Dixit and Joshi (1983)
Anethum graveolus	Seeds	Aqueous	70 and 100 mg kg^{-1} day^{-1}	32 days	Alkaloids Saponins Terpenoids	Rat	Antispermatogenic effect	Malihezaman and Sara (2007)
Aspillia africana	Leaf	Methanol	100, 200 and 400 mg kg^{-1} day^{-1}	52 days	Tanins Phenols	Rat	Antispermatogenic effect	Ruth *et al.* (2015)
Ananas comosus	Unripe fruit	Ethanol	200 mg kg^{-1} day^{-1}	60 days	Alkaloids Saponins	Rat	Antispermatogenic activity	Satyawati (1983)
Azadirrachta indica	Leaf	Dry powder	20, 40 and 60 mg kg^{-1} day^{-1}	60 days	Tanins Phenols	Rat	Decrease in weight of seminal vesicles	Shaikh *et al.* (1993), Joshi *et al.* (1996), Meymand *et al.* (2002), Kasturi *et al.* (2002) and Biswas *et al.* (2002)
							Decreased sperm count	
							Histopathological changes in testis	
			200 mg kg^{-1} day^{-1}	60 days		Rabbit	Reduced sperm count	Aladakatti and Ahmed (2005) and Shaikh *et al.* (2009)

Table 2: Continue

Scientific name	Part used	Solvent	Dosage	Duration	Phytochemical	Animal model	Research findings	References
Bambusa arundinaecea	Buds	Ethanol	100 and 200 mg kg^{-1} day^{-1}	60 days	Tanins Alkaloids Saponins	Rat	Impaired structural and functional activity of the epididymis	Manonayagi *et al.* (1989)
Barleria prionitis	Root	Methanol	100 mg kg^{-1} day^{-1}	60 days	Phenols Alkaloids	Rat	Antispermatogenic activity	Gupta *et al.* (2000) and Verma *et al.* (2005)
Calotropis procera	Stem bark	Ethanol	25 mg kg^{-1} day^{-1}	30 days	Saponins Phenols	Rat	Testicular degenerative changes	Akinloye *et al.* (2002)
Cannabis sativa	Leaf	Methanol	25 mg kg^{-1} day^{-1}	30 days	Alkaloids Saponins	Mouse	Testicular lesion with atrophy of leydig cells	Sailani and Moeini (2007)
Carica papaya	Seeds	Chloroform	20 mg kg^{-1} day^{-1}	60 days	Tanins Saponins	Rat	Anti fertility effect	Pathak *et al.* (2000)
		Aqueous	20 mg kg^{-1} day^{-1}	30 days	Tanins Saponins	Rat	Inhibition of sperm motility	Manivannan *et al.* (2004)
Celastrus paniculatus	Seeds	Ethanol	20 mg kg^{-1} day^{-1}	30 days	Phenols Tanins	Rat	Antispermatogenic effect	Bidwai *et al.* (1990)
Citrullus colocynthis	Root	Ethanol	50, 100 and 200 mg kg^{-1} day^{-1}	60 days	Saponins Tanins		Antiandrogenic effect Testicular degeneration	Mali *et al.* (2001) Chaturvedi *et al.* (2003)
Chromolaena odorata	Leaf	Aqueous	250 and 500 mg kg^{-1} day^{-1}	14 days	Glycosides Alkaloids Tanins	Rat	Antiandrogenic effect	Yakubu *et al.* (2007)
Curwma longa	Rhizome	Alcohol	500 mg kg^{-1} day^{-1}	60 days	Curcumin Saponins Tanins	Rat	Antispermatogenic effect	Ashok and Meenakshi (2004)
		Aqueous	600 mg kg^{-1} day^{-1}	56 and 84 days		Mice	Suppression of spermatogenesis and fertility	Mishra and Singh (2009a)
Daucus carota	Tuber	Aqueous	0.5 g kg^{-1} day^{-1}	60 days	Phenols Tanins	Rat	Antispermatogenic activity	Shah and Varute (1980)
Fadogia agrestis	Stem	Aqueous	18, 50 and 100 mg kg^{-1} day^{-1}	28 days	Tanins Saponins	Rat	Reduced testicular function	Yakubu *et al.* (2008)
Gossypol herbacum	Seed	Aqueous	0.3 and 30 mg kg^{-1} day^{-1}	60 days	Phenols Alkaloids	Rat	Antifertility effect	Zhuang *et al.* (1986) Udoh *et al.* (1992)
Leptadenia hostata	Leaf and stem	Aqueous	100, 200, 400 and 800 mg kg^{-1} day^{-1}	60 days	Saponins Tanins	Rat	Antispermatogenic effect	Bayala *et al.* (2011)
Momordica charantac	Leaf	Alcohol	25 mg/100 g/day	35 days	Alkaloids Saponins	Rat	Antispermatogenic, antisteroidogenesis, anti androgenic activities	Naseem *et al.* (1998)
	Seed	Methanol	5 mg kg^{-1} day^{-1}	60 days		Rat	Antifertility	Yama *et al.* (2011)
Morida lucinda	Leaf	Aqueous	400 mg kg^{-1} day^{-1}	13 weeks	Flavonoids Alkaloids Tanins	Rat	Antispermatogenic properties	Raji *et al.* (2005)

Table 2: Continue

Scientific name	Part used	Solvent	Dosage	Duration	Phytochemical	Animal model	Research findings	References
Mucuna urens	Seed	Ethanol	70, 140 and 210 mg kg^{-1} day^{-1}	14 days	Saponins Phenols	Rat	Antispermatogenic activity	Etta *et al.* (2009)
Nicotiana tubacum	Leaf	Ethanol	100 mg and 200 mg kg^{-1} day^{-1}	60 days	Glycosides Alkaloids Saponins	Rat	Antiandrogeenic effects	Londonkar *et al.* (1998)
Piper nigrum	Fruit	Methanol	10 and 100 mg kg^{-1} day^{-1}	30 days	Saponins Tanins	Rat	Decreased sperm viability	D'Cruz and Mathur (2005)
	Fruit	Dry powder	25 and 100 mg kg^{-1} day^{-1}	20 and 90 days		Mice	Antispermatogenic activity	Mishra and Singh (2009b)
Pterocarpus santalinus	Stem	Aqueous	100 mg kg^{-1} day^{-1}	60 days	Saponins Steroids	Mice	Semen coagulating activity	Dhawan *et al.* (1980)
Ricinus communis	Seed	Ethanol	100 mg kg^{-1} day^{-1}	60 days	Alkaloids Tanins	Rat	Alteration in the mobility mode of movement and morphology of sperms	Sandhyakumary *et al.* (2003)
Syzygium aromaticum	Flower buds	Hexane	15, 30 and 60 mg kg^{-1} day^{-1}	35 days	Phenols Saponins	Mice	Degenerative changes in the seminiferous tubules	Mishra and Singh (2008)
Tecoma stans	Leaf	Ethanol	500 mg kg^{-1} day^{-1}	60 days	Phenols Alkaloids	Rat	Antispermatogenic effect	Mathurr *et al.* (2010)
Terminalia superba	Fruit	Ethanol	50 and 100 mg kg^{-1} day^{-1}	60 days	Saponins Tanins	Rat	Antiandrogenic effect	Srivastav *et al.* (2010)
Thevetia peruviana	Stem bark	Methanol	100 mg kg^{-1} day^{-1}	60 days	Alkaloids Tanins	Rat	Antispermatogenic effect	Gupta *et al.* (2011)
Tinospera cordifolia	Stem	Methanol	100 mg kg^{-1} day^{-1}	60 days	Phenols Alkaloids	Rat	Anti-iandrogenic effect	Premanath and Lakshmidevi (2010)
Trigonella foenum-graecum	Seed	Dry powder	100 mg kg^{-1} day^{-1}	60 days	Flavonoids Saponins	Rat	Antispermatogenic effect	Kassem *et al.* (2006)
Vigna ungiculata	Leaf	Aqueous	200 mg kg^{-1} day^{-1}	30 days	Pure alkaloids	Rat	Antispermatogenic effect	Umapathy (1993)
Zizyphus mauritania	Bark	Aqueous	0.1 and 0.5 mg mL^{-1}	60 days	Saponins Glycosides	Rat	Spermicidal properties	Dubey *et al.* (2011)

- *Abrus precatorius* (Fig. 1)
- Common name:
  - Jumble beads
- Local nigerian name:
  - Oju ologbo (Yoruba)
  - Damar Zaya (Hausa)
  - Anya Mumu (Igbo)
- Therapeutic/folkloric use:
  - Cough
  - Convulsion
  - Anemia
  - Aphrodisiac
  - Ulcer

Testicular degeneration characterized by reduced number of cells in the epithelium along with reduction in the number of sperm cells was observed when the aqueous extract of *Abrus precatorious* was administered to male rats at doses of 400, 800 and 1600 mg kg^{-1} b.wt. for 18 days (Adedapo *et al*., 2007). The alcoholic seed extracts of *Abrus precatorious* at a dose of 100 mg kg^{-1} b.wt. for 60 days significantly lowered cauda epididymal sperm motility and brought about a decrease in the levels of succinate dehydrogenase and ATPase in the sperm of albino rats. Scanning electron microscopic studies on sperm morphology revealed decapitation, acrosomal damage and formation of bulges on the mid piece region of sperms following exposure to *Abrus precatorious* seed extracts (Rao, 1987). Irreversible impairment of the motility of human spermatozoa at a concentration of 20 mg mL^{-1} of the methanol extract of *Abrus precatorious* seed extracts was reported, which may be due to the decline in cAMP and enhanced generation of reactive oxygen species (Ratnasooriya *et al*., 1991). Dose-dependent decrease in the enzyme activity of 3α, 3β, 17β-hydroxysteroid dehydrogenases and degeneration of leydig cells were reported when *Abrus precatorius* was administered to male rats (Sinha and Mathur, 1990).

Administration of methanolic extract of the seeds of *A. precatorius* (Fabaceae) (20 and 40 mg kg^{-1} b.wt. day^{-1}) for 45 days in adult male mice caused a significant decrease in caudal sperm motility, count and viability. There was a complete suppression of fertility at 40 mg kg^{-1} dose level. The decrease in weights of testes and *Cauda* epididymis of mice at 40 mg kg^{-1} level was also observed (Bhatt *et al*., 2007).

Methanolic extract of *A. precatorius* seeds (5.0 and 20.0 mg mL^{-1}) showed inhibitory effects on the motility of washed human spermatozoa. The extract caused a concentration-related impairment of percentage sperm motility. With the highest concentration tested (20.0 mg mL^{-1}), the onset of the antimotility action was almost immediate. In addition, this concentration impaired the functional integrity of the plasma membrane (hypo-osmotic swelling test) and viability (nigrosin-eosin stain) of spermatozoa (Ratnasooriya *et al*., 1991).

Oral administration of crude mixture of *A. precatorius* seeds at dose of 50 mg kg^{-1} b.wt., caused reduction in the epididymal sperm count and reduced level of testosterone was also observed (Gigani *et al*., 2012):

- *Albizzia lebbeck* (Fig. 2)
- Common name:
  - Siris

Fig. 1: *Abrus precatorius*

Fig. 2: *Albizzia lebbeck*

Fig. 3: *Acacia auriculaeformis*

Fig. 4: *Acacia concinna*

- Local nigerian name:
  - Lgbagbo (Yoruba)
  - Esheye shege (Bini)
- Therapeutic/folkloric use:
  - Diarrhea
  - Low back pain

In male rats the methanolic extract of *Albizzia lebbeck* pods causes spermatogenic arrest and brought about a significant decrease in sperm motility and density. There was a marked reduction in the numbers of primary spermatocytes, secondary spermatocytes and spermatids (Gupta *et al*., 2004). Further, administration of saponins isolated from *Albizzia lebbeck* L. (50 mg kg^{-1} b.wt. day^{-1}) for 60 days caused a significant decrease in the weights of reproductive organs of rats. The population of various spermatogenic cells in seminiferous tubules decline significantly (Gupta *et al*., 2005):

- *Acacia auriculaeformis* (Fig. 3)
- Common name:
  - Auri
- Local nigerian name:
  - Kasisa eleti (Yoruba)
- Therapeutic/folkloric use:
  - Astringent

In male rats, triterpene extract of the bark of *Acacia auriculaeformis* at 20 and 50 mg kg^{-1} b.wt., for 40 days caused a sperm immobilizing effect (Pakrashi *et al*., 1991):

- *Acacia concinna* (Fig. 4)
- Common name:
  - Velvet bean
- Local nigerian name:
  - Yerepe (Yoruba)
- Therapeutic/folkloric usage:
  - Ant-dandruff
  - Skin diseases

Acacia concinna is a climbing shrub. The tree is food for the larvae of butterfly.

Methanolic extract of the bark of *Acacia concinna* 20 and 50 mg kg^{-1} b.wt., for 40 days was shown to have spermicidal and semen coagulating effects in the rat (Kamboj and Dhawan, 1982):

- *Allamanda cathartica* (Fig. 5)
- Common name:
  - Golden Trumpet
- Local nigerian name:
  - Orogbo-erin (Yoruba)
  - Izeni (Edo)
- Therapeutic/folkloric use:
  - Cough
  - Waist pain
  - Yellow fever

Allamanda cathartica L. (Apocyanaceae) is widely growing perennial shrub. The leaves are smooth and

Fig. 5: *Allamanda cathartica*

Fig. 6: *Allium sativum*

thick (Islam *et al*., 2010). The roots are used against jaundice, complications with malaria and enlarged spleen in traditional medicine. The flowers act as a laxative. Moreover, yellow Allamandah as also antibiotic action against Staphylococcus (Nayak *et al*., 2006).

All parts of the plant contain allamandin, a toxic iridoid lactone. Leaves and stems yield ursolic acid, β-amyrin and β-sitosterol. Plumericin and isoplumericin are extracted from stem and root-bark, also from leaves and roots, besides plumieride and long chain esters (Nithya and Muthumary, 2011).

The oral administration of aqueous leaf extract of *A. cathartica* (150 mg kg^{-1} b.wt. day^{-1} for 14, 28 and 42 days) induces infertility and changes in various male reproductive endpoints in Parkes strain mice. Histologically, testes in extract-treated mice showed non-uniform degenerative changes in the seminiferous. The treatment also had adverse effects on motility, viability, morphology and on number of spermatozoa in the cauda epididymidis. Fertility of the extract-treated males was also suppressed (Singh and Singh, 2008):

- *Allium sativum* (Fig. 6)
- Common name:
  - Garlic
- Local nigerian name:
  - Ayuu (Yoruba)
  - Tafarnawa (Hausa)
  - Ayo (Igbo)
- Therapeutic/folkloric use:
  - Stroke
  - Eye pains

Allium sativum, commonly called garlic is a species in the onion genus.

The crude aqueous extract of *Allium sativum* bulb possesses spermicidal activity and showedthe most promising results by instantimmobilization of the epididymal sperm at 0.25 g mL^{-1} and human ejaculated sperm at 0.5 g mL^{-1}.

More than 50% reduction in sperm viability occurred in treated sperm, indicating the possibility of plasma membrane disintegration which was further supported by the significant reduction in the activity of membrane bound nucleotidase and acrosomal acrosin (Chakrabarti *et al*., 2003). On the testes, use of garlic has been noted to compromise some male reproductive functions, as it affects spermatogenesis and testosterone levels, which are vital to reproduction (Hammami *et al*., 2008, 2009).

Administration of aqueous extract of garlic different doses (500 and 1000 mg kg^{-1} day^{-1}) to the wistar rats caused reduction in the percentage of morphologically normal spermatozoa as well as sperm concentration (Omotoso *et al*., 2010):

- *Aloe barbadensis* (Fig. 7)
- Common name:
  - Aloe vera
- Local Nigerian name:
  - Alon erin (Yoruba)

Fig. 7: *Aloe barbadensis*

Fig. 8: *Anethum graveolens*

- Ibube agu (Igbo)
- Tinya (Hausa)

- Therapeutic/folkloric use:
  - Cancer eczema
  - Wounds
  - Acne
  - Ulcer
  - Impotence

Aloe babadensis is a succulent plant species. About 50% ethanolic extract *Aloe barbadensis* leaf extract 70 and

Fig. 9: *Aspillia Africana*

100 mg kg^{-1} b.wt. day^{-1} for 56 days showed antiandrogenic activity in the dog (Dixit and Joshi, 1983):

- *Anethum graveolens* (Fig. 8)
- Common name:
  - Soya
- Local nigerian name:
  - Alasisede (Yoruba)
- Therapeutic/folkloric use:
  - Headache
  - Malaria

About 70 mg and 100 mg kg^{-1} b.wt. day^{-1} for 32 days of acqueos extract of *Anethum graveolens* seed extract exhibited antispermatogenic effects in the rat (Malihezaman and Sara, 2007):

- *Aspillia Africana* (Fig. 9)
- Common name:
  - Bush marigold
  - Friend of pepper
- Local nigerian name:
  - Yun yun (Yoruba)
  - Kalankwa (Hausa)
  - Urangila (Igbo)
- Therapeutic/folkloric use:
  - Stop bleeding
  - Promotes healing
  - Antimalarials

Fig. 10: *Ananas comosus*

Fig. 11: *Azadirachta indica*

Methanol leaf extract of *Aspillia africana* 100, 200, 400 mg kg^{-1} b.wt. day^{-1} for 52 days showed antispermatogenic effect in rat (Ruth *et al*., 2015):

- *Ananas comosus* (Fig. 10)
- Common name:
  - Pineapple
- Local nigerian name:
  - Ogede-oyibo (yoruba)
  - Akwu-oyibo (Igbo)
  - Mbuer u buter (Tiv)
  - Eyop mbakara (Efik)
- Therapeutic/folkloric use:
  - Purgative
  - Stomach upset

Ananas comosus also called pineapple is a tropical plant with multiple fruit consisting of coalesced berries. Ethanol extract of unripe fruit of *Ananas cosmosus* 200 mg kg^{-1} b.wt. day^{-1} for 60 days showed antispermatogenic activity in rat (Satyawati, 1983):

- *Azadirachta indica* (Fig. 11)
- Common name:
  - Neem
- Local nigerian name:
  - Dogonyaro (Hausa)/(Yoruba)/(Edo)/(Tiv)
- Therapeutic/folkloric use:
  - Malaria
  - Chicken pox
  - Antifungal
  - Antibacterial
  - Antihelminths

Administration of *A. indica* are reduced the fertilizing activity and administration of dry powder of leaves of *A. indica* at the dose level of 20, 40 and 60 mg rat^{-1} day^{-1} results in a decrease in weight of seminal vesicle and decrease in the sperm count (Shaikh *et al*., 1993).

Histopathological and biochemical changes in the testis of rats treated with the leaf powder of *A. indica* were reported (Joshi *et al*., 1996). It suggested a possible reversible antiandrogenic property of the leaves of *A. indica* in male albino rats. Neem seed extract is reported to induce abnormality in spermatogenesis and sperms production in some of the seminiferous tubules (Meymand *et al*., 2002). Ultrastructural changes like intracellular spaces and vacuolization in sertoli cells and defects in the mitochondrial sheath of late spermatids were induced by leaves of *A. indica* (Neem) in the testis of albino rats (Kasturi *et al*., 2002). Neem oil proved spermicidal against rhesus monkey and human spermatozoa *in vitro*. Antifertility effect of neem oil has also been studied and suggested to be a novel method of contraception (Biswas *et al*., 2002). Contraceptive effects of *A. indica* leaves (500 mg kg^{-1} b.wt. day^{-1}) on testosterone (0.25 mg kg^{-1} b.wt. day^{-1}) were also studied in male rats (Aladakatti and Ahamed, 2005). Inclusion of neem leaf meal up to 15% in the ration of matured rabbit bucks could cause mild supressive effect on the spermatogenesis, semen quality and seminiferous tubule

Fig. 12: *Bambusa arundinaecea*

Fig. 13: *Barleria prionitis*

diameter male albino rat treated with low dose (0.6 mL of neem oil/animal) and high dose (1.2 mL of neem oil/animal) of neem oil revealed significant decrease in the seminiferous tubular diameter and number of spermatozoa (Shaikh *et al*., 2009):

- *Bambusa arundinaecea* (Fig. 12)
- Common name:
  - Common bamboo
- Local nigerian name:
  - Gora (Hausa)
  - Kewal, kewe (Fulfude)
  - Songough (Tiv)
  - Otosi (Ibo)
- Therapeutic/folkloric use:
  - Stomach upset
  - Antimalarial

Bamboo buds ethanolic extract given 100 and 200 mg kg^{-1} b.wt. daily for 60 days demonstrated impaired structural and functional activity of the epididymis in the rat (Manonayagi *et al*., 1989):

- *Barleria prionitis* (Fig. 13)
- Common name:
  - Porcupine flower
- Local nigerian name:
  - Sinkinmini (Yoruba)
- Therapeutic/folkloric use:
  - Fever
  - Antimalarial

Also known as the porcupine flower is a species in the family Acanthaceae.

Male rats treated with isolated fractions of the *B. prionitis* root methanolic extract (100 mg kg^{-1} for 60 days) showed a significant reduction on spermatogenesis without affecting general body metabolism. Sperm motility as well density in cauda epididymides was reduced significantly. The population of various spermatogenic cells such as primary spermatocytes, secondary spermatocytes and round spermatids were declined significantly in treated animals (Verma *et al*., 2005).

Oral administration of root extract of *B. prionitis* L. to male rats (100 mg rat^{-1} day^{-1}) for the period of 60 days did not cause body weight loss. The root extract brought about an interference with spermatogenesis. The round spermatids were decreased by 73.6% ($p \leq 0.001$). The extract reduced the fertility of male rats by 100%. Cross sectional surface area of Sertoli cells and mature leydig cell numbers were significantly reduced (36.9%). Testicular glycogen contents were low. Antifertility effects of Barleria seemed to be mediated by disturbances in testicular somatic cells functions (Leydig and sertoli cells) resulting in the physio-morphological events of spermatogenesis (Gupta *et al*., 2000):

Fig. 14: *Calotropis procera*

Fig. 15: *Cannabis sativa*

- *Calotropis procera* (Fig. 14)
- Common name:
  - Apple of sodom
- Local nigerian name:
  - Bomubomu (yoruba)
- Therapeutic/folkloric use:
  - Measles
  - Diaphoretic emetic
  - Asthma
  - Antipyretic

Fig. 16: *Carica papaya*

This plant is also popularly referred to as giant milk weed. It is used to treat headache, painful swellings and carious tooth (Iwu, 1993). It was found to decrease testicular weight and it caused testicular degenerative changes in Wistar rat (Akinloye *et al*., 2002):

- *Cannabis sativa* (Fig. 15)
- Common name:
  - Ganja
  - Indian hemp
- Local nigerian name:
  - Igbo (Yoruba)
  - Nwonkaka (Igbo)
  - Ikya (Tiv)
- Therapeutic/folkloric use:
  - Mood stimulant
  - Sedative

Cannabis sativa is an annual herbaceous plant in the cannabis genus, a species of the cannabaceae family.

Methanolic leaf extract of *Cannabis sativa* 25 mg kg^{-1} b.wt. day^{-1} given for 30 days caused testicular lesion with atrophy of the leydig cells in the mouse (Sailani and Moeini, 2007):

- *Carica papaya* (Fig. 16)
- Common name:
  - Pawpaw
- Local nigerian name:
  - Ibepe (Yoruba)

Fig. 17: *Celastrus paniculatus*

- Gwanda (Hausa)
- Okwuru bekoe (Igbo)
- Mpuer (Tiv)

- Therapeutic/folkloric use:
  - Constipation
  - Stomach upset

The benzene chromatographic fractions of chloroform extract of the seeds of *C. papaya* possess reversible male contraception potential and the effect appears to be mediated through the testis without adverse toxicity (Pathak *et al*., 2000). Even aqueous extract of papaya bark has potential contraceptive activity. Further studies revealed that the inhibition of sperm motility may be due to ultrastructural changes in epididymis (Manivannan *et al*., 2004):

- *Celastrus paniculatus* (Fig. 17)
- Common name:
  - Intellect tree
- Local nigerian name:
  - Rimi (Hausa)
  - Vambe (Tlv)
- Therapeutic/folkloric use:
  - Convulsion
  - Headache

Celastrus paniculatus is a woody liana commonly known as black oil plant, climbing staff tree and intellect tree.

Ethanolic extract of *Celastrus paniculatus* seed 20 mg kg^{-1} b.wt. day^{-1} for 30 days showed antispermatogenic activity in rat (Bidwai *et al*., 1990):

Fig. 18: *Citrullus colocynthis*

- *Citrullus colocynthis* (Fig. 18)
- Common name:
  - Bitter gourd
  - Wild gourd
- Local Nigerian name:
  - Kwantowa (Hausa)
  - Egwusi (Igbo)
- Therapeutic/folkloric use:
  - Laxative
  - Sexually transmitted diseases
  - Epilepsy

Administration of crude 50% ethanol extract of *C. colocynthis* schrad roots to male albino rats at dose levels of 50, 100 and 200 mg kg^{-1} b.wt. day^{-1} for a period of 60 days caused a significant decreases in cauda epididymal sperm motility, density, number of pups and fertility (Mali *et al*., 2001). The 50% ethanolic extract of *C. colocynthis* extract showed an antiandrogenic nature, thereby reduced reversible infertility in male albino rats. The testes showed degenerative changes in the seminiferous epithelium and arrest of spermatogenesis at the secondary spermatocyte stage (Chaturvedi *et al*., 2003):

- *Chromolaena odoratum* (Fig. 19)
- Common name:
  - Siam weed
- Local nigerian name:
  - Akintola/Awolowo (Yoruba)
  - Obiarakaka (Igbo)
  - Ebe Awolowo (Edo)

Fig. 19: *Chromolaena odoratum*

Fig. 20: *Curcurma longa*

- Therapeutic/folkloric use:
  - Stops bleeding heals wounds
  - Indigestion
  - Stomach upset

Chromolaena odorata (Asteraceae) commonly known as Siam weed is a fast-growing perennial and invasive weed.

Oral administration of aqueous extract of *C. odoratum* leaves (250 and 500 mg kg^{-1} b.wt.) for 14 days in male albino rats revealed a significant reduction ($p<0.05$) in testicular body weight ratio and histological examination revealed disruption in the arrangement of seminiferous tubules with no distinct basement membrane. These changes were accompanied by reduction in the number of spermatozoa. All these results indicated that aqueous extract of *C. odoratum* leaves possesses antiandrogenic property by interfering with steroidogenesis at the testicular level and this will adversely affect the functional capacity of the testes and the fertility of the animal (Yakubu *et al*., 2007):

- *Curcurma longa* (Fig. 20)
- Common name:
  - Tumeric
- Local nigerian name:
  - Ata-Ile Pupa (Yoruba)
- Therapeutic/folkloric use:
  - Heart
  - Liver and chest problems
  - Fever ringworm

Rats fed with *Curcuma longa* aqueous and 70% alcoholic extract for 60 days (500 mg kg^{-1} day^{-1}) showed a reduction in sperm motility and density. *C. longa* may have affected the androgen synthesis either by inhibiting the Leydig cell function or the hypothalamus pituitary axis and as a result, spermatogenesis is arrested (Ashok and Meenakshi, 2004).

Male mice of the Parkes (P) strain were orally administered aqueous rhizome extract of *C. longa* (600 mg kg^{-1} b.wt. day^{-1} for 56 and 84 days) showed adverse effect of on various male reproductive organs and fertility. The treatment had adverse effects on motility, viability, morphology and number of spermatozoa in the cauda epididymidis, serum level of testosterone and on fertility. By 56 days of treatment withdrawal, however, the above parameters recovered to control levels. The results show that *C. longa* treatment causes reversible suppression of spermatogenesis and fertility, thereby suggesting the potential of this plant in the regulation of male fertility (Mishra and Singh, 2009a):

- *Daucus carota* (Fig. 21)
- Common name:
  - Carot
- Local nigerian name:
  - Karoti (Hausa)
- Therapeutic/folkloric use:
  - Anti-inflammatory
  - Anti-rheumatic
  - Fever

Fig. 21: *Daucus carota*

Fig. 22: *Fadogia agrestis*

Aqueous extract of *Daucus carota* tuber 0.5 g kg^{-1} b.wt. day^{-1} given for 60 days exhibited anti-spermatogenic activity in the rat (Shah and Varute, 1980):

- *Fadogia agrestis* (Fig. 22)
- Common name:
  - Black magic
- Local Nigerian name:
  - Bakin gagai (Hausa)
- Therapeutic/folkloric use:
  - Black aphrodisiac

Fig. 23: *Gossypol herbaceum*

Aqueous extract of the *Fadoga agrestis* stem 18, 50, 100 mg kg^{-1} b.wt. day^{-1} for 28 days showed reduced testicular function in rat (Yakubu *et al*., 2008).

- *Gossypol herbaceum* (Fig. 23)
- Common name:
  - Cotton
- Local nigerian name:
  - Mou (Tiv)
  - Auduga (Hausa)
  - Owu (Igede)
  - Ro afor (Igbo)
  - Igi-ora (Yoruba)
- Therapeutic/folkloric use:
  - Wound dressing
  - General infertility
  - Ailments

Gossypol, a yellow polyphenolic compound present in the stem, seeds and roots of *Gossypium* species. It is known to exert unique and selective effects upon reproduction in various species such as rats, mice, hamsters, rabbits, monkeys and human beings (Coutinho, 2002). The contraceptive effect of gossypol was first discovered in China. Gossypol was reported to invoke antifertility effects in rats at 30 mg kg^{-1} b.wt., whereas a much lesser dose, 0.3 mg kg^{-1} b.wt., could incite infertility in humans, making the compound very efficient in humans than in rats (Udoh *et al*., 1992).

Several studies affirm that gossypol treatment reduced the level of serum testosterone and luteinizing hormones

Fig. 24: *Leptadenia hastata*

Fig. 25: *Momordica charantia*

in dose and duration dependent manner (Zhuang *et al*., 1986). Gossypol acts directly on testes and induces azoospermia or oligospermia (Zhuang *et al*., 1986):

- *Leptadenia hastate* (Fig. 24)
- Common name:
  - Tears
- Local nigerian name:
  - Yaadiya (Hausa)
- Therapeutic/folkloric use:
  - Cancer
  - Antimicrobials

Aqueous leaf and stem extract of *Leptadenia hastata* 100, 200, 400, 800 mg kg^{-1} b.wt. day^{-1} given for 60 days showed anti-spermatogenic activity in rat (Bayala *et al*., 2011):

- *Momordica charantia* (Fig. 25)
- Common name:
  - African cucumber
- Local nigerian name:
  - Daddagu (Hausa)
  - Ejinrin (Yoruba)
  - Alaban adene (Ibo)
  - Dagdaye (Kanuri)
- Therapeutic/folkloric use:
  - Asthma
  - Cough
  - Liver problems

Petroleum ether, benzene and alcohol extracts of the seeds of *Momordica charantia* tested in rats at the dose level of 25 mg/100 g b.wt. for 35 days showed antispermatogenic activity as the number of spermatocytes, spermatids and spermatozoa decreased.

Increase in cholesterol level and sudanophilic lipid accumulation indicates inhibition in the steroidogenesis. Out of the three extracts, the alcohol extract was more potent in its antispermatogenic, antisteroidogenic and androgenic activities (Naseem *et al*., 1998). It has been shown that oral administration of *M. charantia* root extract (5 mg kg^{-1} b.wt. day^{-1} for 60 days) showed 100% antifertility in the rats (Yama *et al*., 2011). There was marked decline in testicular germ cell population, leydig cell number and nuclear area as comported to controls. Serum testosterone level also reduced after extract treatment:

- *Morinda lucida* (Fig. 26)
- Common name:
  - Brimestone tree
- Local nigerian name:
  - Oruwo (Yoruba)
  - Njisi (Hausa)
  - Eze Ogu (Igbo)
  - Ufu ogile (Igede
- Therapeutic/folkloric use:
  - Fever
  - Antimalarial
  - Diabetes
  - Heart diseases

Fig. 26: *Morinda lucida*

Fig. 27: *Mucuna urens*

Morinda lucida is an evergreen shrub or small to medium-sized tree bearing a dense crow of slender, crooked branches.

Aqueous leaf extract of Morinda lucida 400 mg kg^{-1} b.wt. day^{-1} for 13 weeks had antispermatogenic properties on the rat (Raji *et al*., 2005):

- *Mucuna urens* (Fig. 27)
- Common name:
  - Cow itch plant
  - Velvet bean

Fig. 28: *Nicotiana tabacum*

- Local nigerian name:
  - Ewe-ina
  - Yerepe (Yoruba)
  - Agba Ohia (Igbo)
- Therapeutic/folkloric use:
  - Blood tonic
  - Intestinal worms
  - Genito-urinary disease

Ethanolic seed extract of *Mucuna urens* 70, 140, 210 mg kg^{-1} b.wt. day^{-1} for 14 days exhibited anti-spermatogenic activity in the rat (Etta *et al*., 2009):

- *Nicotiana tabacum* (Fig. 28)
- Common name:
  - Tobacco
- Local nigerian name:
  - Ewe (Yoruba)
  - Taba (Hausa)
  - Anwere (Igbo)
  - Itaba (Edo)
  - Taav (Tiv)
- Therapeutic/folkloric use:
  - Convulsion
  - Epilepsy,
  - Toothache
  - Ringworm
  - Cold
  - Ulcers

Fig. 29: *Piper nigrum*

Fig. 30: *Pterocarpus santalinus*

Ethanolic leaf extract of *Nicotiana tabacum* 100, 200 mg kg^{-1} day^{-1} for 60 days showed anti-androgenic effect in the rat (Londonkar *et al*., 1998):

- *Piper nigrum* (Fig. 29)
- Common name:
  - Black pepper
- Local nigerian name:
  - Iyere (Yoruba)
  - Uzize (Igbo)
  - Masooroo (Hausa)
- Therapeutic/folkloric use:
  - Constipation
  - Anti-inflammatory

Piper nigrum L. commonly known as black pepper belongs to family Piperaceae. The fruits of *P. nigrum* are not only important as a spice or flavoring agent but have also been prescribed for cholera, dyspepsia, diarrhea, various gastric ailments and paralytic and arthritic disorders.

Oral administration of fruit powder of *P. nigrum* (25 and 100 mg kg^{-1} b.wt. day^{-1} for 20 and 90 days) to male mice of the Parkes (P) strain adversely affects sperm parameters and also caused marked alterations in male reproductive organs (Mishra and Singh, 2009b).

Piperine (1-piperoylpiperidine) is an alkaloid present in the fruits of black pepper (*Piper nigrum*), long pepper (*Piper longum*) and other piper species. Epididymal sperm count and motility decreased at 10 and 100 mg kg^{-1} and sperm viability decreased significantly at 100 mg kg^{-1}. Piperine could damage the epididymal environment and sperm function (D'Cruz and Mathur, 2005):

- *Pterocarpus santalinus* (Fig. 30)
- Common name:
  - Red sandal
- Local nigerian name:
  - Gbengbe (Yoruba),
  - Gunduruu (Hausa),
  - Nturukpa (Igede)
- Therapeutic/folkloric use:
  - Skin diseases
  - Antipyretic
  - Antidiarrhoea

Aqueous extract of *Pterocarpus santalinus* stem 100 mg kg^{-1} day^{-1} for 60 days demonstrated semen coagulating activity in mice (Dhawan *et al*., 1980):

- *Ricinus communis* (Fig. 31)
- Common name:
  - Castor bean
- Local nigerian name:
  - Lara pupa (Yoruba)
  - Kulakula Nkpikpi (Hausa)
- Therapeutic/folkloric use:
  - Veneral diseases

Ethanolic extract of *Ricinus communis* seed 100 mg kg^{-1} day^{-1} for 60 days showed alteration in

Fig. 31: *Ricinus communis*

Fig. 32: *Syzygium aromaticum*

motility, mode of movement and morphology of sperms in rat (Sandhyakumary *et al*., 2003):

- *Syzygium aromaticum* (Fig. 32)
- Common name:
  - Clove
- Local nigerian name:
  - Kanum fari (hausa)
- Therapeutic/folkloric use:
  - Cough and catarrh

Fig. 33: *Syzygium cuminii*

Syzygium aromaticum L. commonly known as clove belongs to family Myrtaceae. It is used as a spice to add flavor to exotic food preparations.

Oral exposure of hexane extract of flower buds of *S. aromaticum* in three doses (15, 30 and 60 mg kg^{-1} b.wt.) for a single spermatogenic cycle (35 days) in Parkes (P) strain mice induced non-uniform degenerative changes in the seminiferous tubules associated with decrease in daily sperm production and depletion of round and elongated spermatids population (Mishra and Singh, 2008):

- *Syzygium cuminii* (Fig. 33)
- Common name:
  - Skeels
- Local nigerian name:
  - Ori (Yoruba)
  - Malmoo (Hausa)
- Therapeutic/folkloric use:
  - Purgative

Alcohol extract of the seed of *Syzygium cuminii* 100 mg kg^{-1} day^{-1} for 60 days showed anti-spermatogenic effect in rat (Shad *et al*., 2014):

- *Tecoma stans* (Fig. 34)
- Common name:
  - Yellow bells
- Local nigerian name:
  - Awun (Yoruba)
  - Ukhu (bini)

Fig. 34: *Tecoma stans*

Fig. 35: *Terminalia superba*

- Therapeutic/folkloric use:
  - Antimalarial

Ethanol leaf extract of *Tecoma stans* 500 mg kg^{-1} day^{-1} for 60 days demonstrated anti-spermatogenic effect in rat (Mathur *et al*., 2010):

- *Terminalia superba* (Fig. 35)
- Common name:
  - Black limba

Fig. 36: *Thevetia peruviana*

- Local Nigerian name:
  - Afara (Yoruba)
  - Baushe (Hausa)
- Therapeutic/folkloric use:
  - Antimalarial

Ethanol extract of the fruit of *Terminalia superba* 50 and 100 mg kg^{-1} day^{-1} for 60 days showed anti-androgenic effect in rat (Srivastav *et al*., 2010):

- *Thevetia peruviana* (Fig. 36)
- Common name:
  - Yellow oleandar
  - Suicide tree
- Local nigerian name:
  - Olomojo (Yoruba)
- Therapeutic/folkloric use:
  - Anti -measles
  - Anti-diabetics

Methanol extract of stem bark of *Thevetia peruviana* 100 mg kg^{-1} day^{-1} for 60 days showed ant-spermatogenic effect (Gupta *et al*., 2011):

- *Tinospora cordifolia* (Fig. 37)
- Common name:
  - Hearth leaves
- Local nigerian name:
  - Epaikum (Yoruba)

Fig. 37: *Tinospora cordifolia*

Fig. 38: *Trigonella foenum-graecum*

- Therapeutic/folkloric use:
  - Anti-inflammatory

Tinospora cordifolia (Willd.) belongs to the Menispermaceae family. It is reported to possess anti-spasmodic, antiinflammatory, anti-allergic, anti-diabetic, antioxidant properties (Premanath and Lakshmidevi, 2010):

- *Trigonella foenum-graecum* (Fig. 38)
- Common name:
  - Wild yam

Fig. 39: *Vigna Ungiculata*

- Local nigerian name:
  - Osanwene (Yoruba)
  - Lemu (Hausa)
  - Olofa-nta (Igbo)
- Therapeutic/folkloric use:
  - Antimalarial
  - Chest diseases
  - Abdominal upset

Trigonella foenum-graecum (Fenugreek) is a member of the Fabaceae family. Fenugreek is native to the area from the eastern Mediterranean to Central Asia and Ethiopia and much cultivated in Pakistan, India and China. Its dried ripe seeds are variously referred to as Trigonella seeds or as Fenugreek.

Trigonella foenum-graecum tends to reduce the male fertility by reducing testosterone concentration, sperms concentration and inhibiting mass and individual motility of the sperms (Kassem *et al*., 2006):

- *Vigna ungiculata* (Fig. 39)
- Common name:
  - Cowpea
- Local Nigerian name:
  - Owi-ahun (Yoruba)
  - Wakia-tunka (Hausa)
- Therapeutic/folkloric use:
  - Toothache

Aqueous extract of leaf of *Vigna ungiculata* 200 mg kg^{-1} day^{-1} for 30 days showed anti-spermatogenic effect in rat (Umapathy, 1993):

Fig. 40: *Zizyphus mauritiana*

- *Zizyphus mauritiana* (Fig. 40)
- Common name:
  - Indian plum
- Local nigerian name:
  - Magarya (Hausa)
- Therapeutic/folkloric use:
  - Antimalarial
  - Abdominal upset

Ziziphus belongs to the kingdom; plantae, order; roasles, division; magnoliophyta, class; magnoliopsida, family; rhamnaceae, genus, Ziziphus. *Z. mauritiana* is a fast growing small to medium-sized, single or multi-stemmed, spiny shrub or tree, which is almost evergreen but is deciduous during the dry season. It can reach up to 12 m tall and 30 cm diameter at breast height but is highly variable in size and general appearance. The bark is dark grey, dull black or reddish with long vertical fissures, reddish and fibrous inside. The branches are spreading and droop at the ends.

Acqueous bark extract of Zizyphus mauritiana 0.1 and 0.5 mg/mL/60 days showed spermicidal properties (Dubey *et al*., 2011).

REFERENCES

Adedapo, A.A., O.A. Omolove and O.G. Ohore, 2007. Studies on the toxicity of an aqueous extract of the leaves of *Abrus precatorius* in rats. Onderstepoort J. Vet. Res., 74: 31-36.

Akinloye, A.K., M.O. Abatan, O.O. Alaka and B.O. Oke, 2002. Histomorphometric and histopathological studies on the effect of *Calotropis procera* (giant milkweed) on the male reproductive organs of wistar rats. Afr. J. Biomed. Res., 5: 57-61.

Akunna, G.G., C.L. Saalu, O.S. Ogunmodede, B. Ogunlade and A.J. Bello, 2012. Aqueous extract of date fruit (*Phoenix dactylifera*) protects testis against atrazine-induced toxicity in rat. World J. Life Sci. Med. Res., 2: 100-108.

Akunna, G.G., L.C. Saalu and A.O. Oyewopo, 2014. The ameliorating capabilities of *Croton zambesicus* leaf extract on the testis of rats exposed to pyrethroid-based insecticide. J. Anatomical Sci., 5: 7-16.

Aladakatti, R.H. and R.N. Ahamed, 2005. Ultrastructural changes in Leydig cells and cauda epididymal spermatozoa induced by *Azadirachta indica* leaves in albino rats. Phytother. Res., 19: 756-766.

Ashok, P. and B. Meenakshi, 2004. Contraceptive effect of *Curcuma longa* (L.) in male albino rat. Asian J. Androl., 6: 71-74.

Bayala, B., P.B. Telefo, I.H.N. Bassole, H.H. Tamboura and R.G. Belemtougri *et al*., 2011. Anti-spermatogenic activity of *Leptadenia hastata* (Pers.) decne leaf stems aqueous extracts in male wistar rats. J. Pharmacol. Toxicol., 6: 391-399.

Bekalo, T.H., D.S. Woodmatas and Z.A. Woldemariam, 2009. An ethnobotanical study of medicinal plants used by local people in the lowlands of Konta Special Woreda, Southern Nations, nationalities and peoples regional state, Ethiopia. J. Ethnobiol. Ethnomed., Vol. 5. 10.1186/1746-4269-5-26

Bhatt, N., S.L. Chawla and M.V. Rao, 2007. Contraceptive evaluation of seed extract of *Abrus precatorius* (L.) in male mice (*Mus musculus*). J. Herbal Med. Toxicol., 1: 47-50.

Bidwai, P.P., D. Wangoo and N. Bhullar, 1990. Antispermatogenic action of *Celastrus paniculatus* seed extract in the rat with reversible changes in the liver. J. Ethnopharmacol., 28: 293-303.

Biswas, K., I. Chattopadhyay, R.K. Banerjee and U. Bandyopadhyay, 2002. Biological activities and medicinal properties of neem (*Azadirachta indica*). Curr. Sci., 82: 1336-1345.

Blumenthal, M., 1999. Harvard study estimates consumers spend $5.1 billion on herbal products? HerbalGram, 45: 68-74.

Calixto, J.B., 2000. Efficacy, safety, quality control, marketing and regulatory guidelines for herbal medicine (phytotherapeutic agents). Braz. J. Med. Biol. Res., 33: 179-189.

Chakrabarti, K., S. Pal and A.K. Bhattacharyya, 2003. Sperm immobilization activity of *Allium sativum* L. and other plant extracts. Asian J. Androl., 5: 131-135.

Chaturvedi, M., P.C. Mali and A.S. Ansari, 2003. Induction of reversible antifertility with a crude ethanol extract of *Citrullus colocynthis* Schrad fruit in male rats. Pharmacology, 68: 38-48.

Coutinho, E.M., 2002. Gossypol: A contraceptive for men. Contraception, 65: 259-263.

Cunningham, A.B., 1993. African medicinal plants: Setting priorities at the interface between conservation and primary healthcare. People and Plants Working Paper 1, March 1993, People and Plants Initiative, Division of Ecological Sciences, Paris, France.

D'Cruz, S.C. and P.P. Mathur, 2005. Effect of piperine on the epididymis of adult male rats. Asian J. Androl., 7: 363-368.

Dhawan, B.N., M.P. Dubey, B.N. Mehrotra, R.P. Rastogi and J.S. Jandon, 1980. Screening of Indian plants for biological activity: Part IX. Indian J. Exp. Biol., 18: 596-606.

Dixit, V.P. and S. Joshi, 1983. Effect of aloe barbadensis and colfibrate on serum lipids in hyperlipidemia in presbytis monkeys. Indian J. Med. Res., 78: 417-421.

Dubey, R., K. Dubey, C. Sridhar and K.N. Jayaveera, 2011. Sperm immobilization activity of aqueous, mathonolic and saponnins extract of bark of *Zizyphus mauritiana*. Der Pharmacia Sinica, 2: 11-16.

Etta, H.E., U.P. Bassey, E.E. Eneobong and O.B. Okon, 2009. Anti-spermatogenic effects of ethanol extract of *Mucuna urens*. J. Reprod. Contraception, 20: 161-168.

Farnsworth, N.R. and D.D. Soejarto, 1985. Potential consequence of plant extinction in the United States on the current and future availability of prescription drugs. Econ. Bot., 39: 231-240.

Gigani, Y., A. Vekaria and S.A. Ali, 2012. Effect of *Abrus precatorius* and *Amaranthus spinosus* combination treatment on fertility in male rats. J. Pharmacol. Pharmacother., 3: 272-273.

Grunwald, J., 1995. The European phytomedicines market: Figures, trends, analysis. Herbalgram, 34: 60-65.

Gupta, R., J.B.S. Kachhawa, R.S. Gupta, A.K. Sharma, M.C. Sharma and M.P. Dobhal, 2011. Phytochemical evaluation and antispermatogenic activity of *Thevetia peruviana* methanol extract in male albino rats. Hum. Fertil., 14: 53-59.

Gupta, R.S., J.B. Kachhawa and R. Chaudhary, 2004. Antifertility effects of methanolic pod extract of *Albizzia lebbeck* (L.) Benth in male rats. Asian J. Androl., 6: 155-159.

Gupta, R.S., P. Kumar, V.P. Dixit and M.P. Dobhal, 2000. Antifertility studies of the root extract of the *Barleria prionitis* Linn in male albino rats with special reference to testicular cell population dynamics. J. Ethnopharmacol., 70: 111-117.

Gupta, R.S., R. Chaudhary, R.K. Yadav, S.K. Verma and M.P. Dobhal, 2005. Effect of saponins of *Albizia lebbeck* (L.) Benth bark on the reproductive system of male albino rats. J. Ethnopharmacol., 96: 31-36.

Hammami, I., A. Nahdi, C. Mauduit, M. Benahmed and M. Amri *et al*., 2008. The inhibitory effects on adult male reproductive functions of crude garlic (*Allium sativum*) feeding. Asian J. Androl., 10: 593-601.

Hammami, I., S. Amara, M. Benahmed, M.V. El May and C. Mauduit, 2009. Chronic crude garlic-feeding modified adult male rat testicular markers: Mechanisms of action. Reprod. Biol. Endocrinol., Vol. 7. 10.1186/1477-7827-7-65

Hess, R.A. and L.R. de Franca, 2008. Spermatogenesis and cycle of the seminiferous epithelium. Adv. Exp. Med. Biol., 636: 1-15.

Hoffman, R.L. and B. Fox, 2006. Alternative Cures that Really Work. Rodale Inc., New York, USA., ISBN-13: 9781594864520, Pages: 388.

Hostettmann, K. and A. Marston, 2002. Twenty years of research into medicinal plants: Results and perspectives. Phytochem. Rev., 1: 275-285.

Islam, M.R., R. Ahamed, M.O. Rahman, M.A. Akbar and M. Al-Amin *et al*., 2010. *In vitro* antimicrobial activities of four medicinally important plants in Bangladesh. Eur. J. Sci. Res., 39: 199-206.

Iwu, M.M., 1993. Handbook of African Medicinal Plants. CRC Press, Boca Raton, ISBN-13: 9781466571976, pp: 214-215.

Joshi, A.R., R.N. Ahamed, K.M. Pathan and B. Manivannah, 1996. Effect of *Azadirachta indica* leaves on testis and its recovery in albino rats. Indian J. Exp. Biol., 34: 1091-1094.

Kamboj, V.P. and B.N. Dhawan, 1982. Research on plants for fertility regulation in India. J. Ethnopharmacol., 6: 191-226.

Kassem, A., A. Al-Aghbari, M. Al-Habori and M. Al-Mamary, 2006. Evaluation of the potential antifertility effect of fenugreek seeds in male and female rabbits. Contraception, 73: 301-306.

Kasturi, M., R.N. Ahamed, K.M. Pathan, B. Manivannan and R.H. Aladakatti, 2002. Ultrastructural changes induced by leaves of *Azadirachta indica* (Neem) in the testis of albino rats. J. Basic Clin. Physiol. Pharmacol., 13: 311-328.

Kirby, G.C., 1996. Medicinal plants and the control of protozoal disease, with particular reference to malaria. Trans. R. Soc. Trop. Med. Hyg., 90: 605-609.

Londonkar, R.L., P. Srinivasreddy, P. Somanathreddy and S.B. Patil, 1998. Nicotine induced inhibition of the activities of accessory reproductive ducts in male rats. J. Ethnopharmacol., 60: 215-221.

Mali, P.C., M. Chaturvedi, A.S. Ansari and V.P. Dixit, 2001. Antispermatogenic effects of an ethanol extract of *Citrullus colocynthis* root in male albino rats. Pharmaceut. Biol., 39: 113-119.

Malihezaman, M. and P. Sara, 2007. Effects of aqueous extract of *Anethum graveolens* (L.) on male reproductive system of rats. J. Boil. Sci., 7: 815-818.

Manivannan, B., P.K. Mishra, N. Pathak, S. Sriram, S.S. Bhande, S. Panneerdoss and N.K. Lohiya, 2004. Ultrastructural changes in the testis and epididymis of rats following treatment with the benzene chromatographic fraction of the chloroform extract of the seeds of *Carica papaya*. Phytother. Res., 18: 285-289.

Manonayagi, S., G. Vanithakumari, S. Padma and T. Malini, 1989. Effects of bamboo buds: Structural and functional changes in the epididymis of rats. J. Ethnopharmacol., 25: 201-212.

Mathur, N., G.C. Jain and G. Pandey, 2010. Effect of *Tecoma stans* leaves on the reproductive system of male albino rats. Int. J. Pharmacol., 6: 152-156.

May, J., 2011. What is integrative health? Br. Med. J., Vol. 343. 10.1136/bmj.d4372

Metz, H.C., 1991. Nigeria: A country study. GPO for the Library of Congress, Washington.

Meymand, M.M., M. Morowati, M.G. Khansari, B. Nasrollazadeh and B. Minaie, 2002. Sterility effects of neem (*Azadirachta indica*) extract on male rat. J. Reprod. Infertility, 3: 4-13.

Mishra, R.K. and S.K. Singh, 2008. Safety assessment of *Syzygium aromaticum* flower bud (clove) extract with respect to testicular function in mice. Food Chem. Toxicol., 46: 3333-3338.

Mishra, R.K. and S.K. Singh, 2009a. Antispermatogenic and antifertility effects of fruits of *Piper nigrum* L. in mice. Indian J. Exp. Biol., 47: 706-714.

Mishra, R.K. and S.K. Singh, 2009b. Reversible antifertility effect of aqueous rhizome extract of *Curcuma longa L.* in male laboratory mice. Contraception, 79: 479-487.

Naseem, M.Z., S.R. Patil, S.R. Patil, Ravindra and S.B. Patil, 1998. Antispermatogenic and androgenic activities of *Momordica charantia* (Karela) in albino rats. J. Ethnopharmacol., 61: 9-16.

Nayak, S., P. Nalabothu, S. Sandiford, V. Bhogadi and A. Adogwa, 2006. Evaluation of wound healing activity of *Allamanda cathartica* L. and *Laurus nobilis* L. extracts on rats. BMC Complement. Altern. Med., Vol. 6. 10.1186/1472-6882-6-12

Nithya, K. and J. Muthumary, 2011. Bioactive metabolite produced by *Phomopsis* sp., an endophytic fungus in *Allamanda cathartica* Linn. Recent Res. Sci. Technol., 3: 44-48.

Odugbemi, T.O., O.R. Akinsulire, I.E. Aibinu and P.O. Fabeku, 2007. Medicinal plants useful for malaria therapy in Okeigbo, Ondo State, Southwest Nigeria. Afr. J. Tradit. Complement. Altern. Med., 4: 191-198.

Omotoso, G.O., A.O. Oyewopo, R.E. Kadir, S.T. Olawuyi and A.A.G. Jimoh, 2010. Effects of aqueous extract of *Allium sativum* (Garlic) on semen parameters in Wistar rats. Internet J. Urol., Vol. 7.

Osinowo, O.A., 2006. Introduction to Animal Reproduction. 1st Edn., Sophie Academic Services Limited, Abeokuta, Nigeria, pp: 91.

Oyewopo, A.O., L.C. Saalu, B.J. Dare, C.I. Oyewopo and A.A. Jimoh *et al*., 2012. Testiculo-protective effect of stem bark extract of *Enantia chlorantha* on lead induced toxicity in adult wistar rat (*Rattus norvergicus*). Reprod. Syst. Sexual Disord., Vol. 1. 10.4172/2161-038X.1000107

Oyewopo, A.O., O.E. Lawal, A.S. Alabi, L.C. Saalu and F.E. Williams, 2014. Comparative effects of *Cissus populnea* extract and *Jatropha curcas* on propoxur-induced testicular toxicity of adult male Wistar rats. J. Anat. Sci., 5: 60-67.

Pakrashi, A., H. Ray, B.C. Pal and S.B. Mahato, 1991. Sperm immobilizing effect of triterpene saponins from *Acacia auriculiformis*. Contraception, 43: 475-483.

Pathak, N., P.K. Mishra, B. Manivannan and N.K. Lohiya, 2000. Sterility due to inhibition of sperm motility by oral administration of benzene chromatographic fraction of the chloroform extract of the seeds of *Carica papaya* in rats. Phytomedicine, 7: 325-333.

Premanath, R. and N. Lakshmidevi, 2010. Studies on anti-oxidant activity of *Tinospora cordifolia* (Miers.) leaves using *in vitro* models. J. Am. Sci., 6: 736-743.

Raji, Y., O.S. Akinsomisoye and T.M. Salman, 2005. Antispermatogenic activity of *Morinda lucida* extract in male rats. Asian J. Androl., 7: 405-410.

Rao, M.V., 1987. Antifertility effects of alcoholic seed extract of *Abrus precatorius* Linn. in male albino rats. Acta Europaea Fertilitatis, 18: 217-220.

Rao, M.R., M.C. Palada and B.N. Becker, 2004. Medicinal and aromatic plants in agroforestry systems. Agrofor. Syst., 61: 107-122.

Ratnasooriya, W.D., A.S. Amarasekera, N.S.D. Perera and G.A.S. Premakumara, 1991. Sperm antimotility properties of a seed extract of *Abrus precatorius*. J. Ethnopharmacol., 33: 85-90.

Robbers, J.E., M.K. Speedie and V.E. Tyler, 1996. Pharmacognosy and Pharmacobiotechnology. Williams and Wilkins, Baltimore, MD., USA., ISBN-13: 9780683085006, pp: 1-14.

Ruggie, M., 2004. Marginal to Mainstream: Alternative Medicine in America. Cambridge University Press, Cambridge, UK., ISBN-13: 9780521834292, Pages: 232.

Ruth, A.O., E.M. Amarachi, M.O. Effiong and E.T. Bassey, 2015. Antispermatogenic activity of *Aspilia Africana* methanol leaf extract in male wistar rats. Br. J. Med. Med. Res., 6: 415-422.

Saalu, L.C., R. Udeh, K.A. Oluyemi, P.I. Jewo and L.O. Fadeyibi, 2008. The ameriorating effects of grapefruit seed extract on testicular morphology and function of varicocelized rats. Int. J. Morphol., 26: 1059-1064.

Saalu, L.C., A.A. Osinubi, J.A. Oguntola, I.O. Adeneye and A.S. Benebo, 2010a. The delayed testicular morphologic effects of doxorubicin and the rejuvinating role of grapefruit seed extract. Int. J. Pharmacol., 6: 192-199.

Saalu, L.C., A.A. Osinubi, P.I. Jewo, A.O. Oyewopo and G.O. Ajayi, 2010b. An evaluation of influence of *Citrus paradisi* seed extract on doxorubicin-induced testicular oxidative stress and impaired spermatogenesis. Asian J. Scient. Res., 3: 51-61.

Saalu, L.C., A.A. Osinubi, A.A. Akinbami, O.E. Yama, A.O. Oyewopo and B.U. Enaibe, 2011. *Moringa oleifera* lamarck (drumstick) leaf extract modulates the evidences of hydroxyurea-induced testicular derangement. Int. J. Applied Res. Nat. Prod., 4: 32-45.

Saalu, L.C., G.G. Akunna and J.O. Ajayi, 2013. Modulating role of bitter leaf on spermatogenic and steroidogenesis functions of the rat testis. Am. J. Biochem. Mol. Biol., 3: 314-321.

Sailani, M.R. and H. Moeini, 2007. Effect of *Ruta graveolens* and *Cannabis sativa* alcoholic extract on spermatogenesis in the adult wistar male rats. Indian J. Urol., 23: 257-260.

Sandhyakumary, K., R.G. Bobby and M. Indira, 2003. Antifertility effects of *Ricinus communis* (Linn) on rats. Phytother. Res., 17: 508-511.

Satyawati, G.V., 1983. Indian Plants and Plant Products with Antifertility Effect. [A Review of Literature between 1975-1982]. ICMR, New Delhi.

Shad, A.A., S. Ahmad, R. Ullah, N.M. Abd El-Salam and H. Fouad *et al*., 2014. Phytochemical and biological activities of four wild m edicinal plants. Scient. World J. 10.1155/2014/857363

Shah, N.V. and A.J. Varute, 1980. Effect of *Daucus carrota* seed extract on male reproductive organs of albino rats. Indian Symp. Life Sci., 91: 217-217.

Shaikh, M.A., S.N.H. Naqvi and M.Z. Chaudhry, 2009. Effect of neem oil on the structure and function of the mature male albino rat testes. Braz. J. Morphol. sci., 26: 49-54.

Shaikh, P.D., B. Manivannan, K.M. Pathan, M. Kasturi and R.N. Ahamed, 1993. Antispermatic activity of *Azadirachta indica* leaves in albino rats. Curr. Sci., 64: 688-689.

Shealy, C.N. and C. Dawson, 2006. Soul Medicine: Awakening Your Inner Blueprint for Abundant Health and Energy. Elite Books, Santa Rose, CA., USA.

Singh, A. and S.K. Singh, 2008. Reversible antifertility effect of aqueous leaf extract of *Allamanda cathartica* L. in male laboratory mice. Andrologia, 40: 337-345.

Sinha, S. and R.S. Mathur, 1990. Effect of steroidal fraction of seeds of *Abrus precatorius* Linn. on rat testis. Indian J. Exp. Biol., 28: 752-756.

Sofowora, A., 1992. Medicinal Plants and Traditional Medicine in Africa. 24th Edn., John Wiley and Sons, New York, USA., Pages: 8.

Srivastav, A., A. Chandra, M. Singh, F. Jamal and P. Rastogi *et al*., 2010. Inhibition of hyaluronidase activity of human and rat spermatozoa *in vitro* and antispermatogenic activity in rats *in vivo* by *Terminalia chebula*, a flavonoid rich plant. Reprod. Toxicol., 29: 214-224.

Udoh, P., D.R. Patil and M.K. Deshpande, 1992. Histopathological and biochemical effects of gossypol acetate on pituitary-gonadal axis of male albino rats. Contraception, 45: 493-509.

Ukwenya, V.O., K.A. Oluyemi, E. Ashamu, C. Saalu, O.O. Oyewo and V.O. Makanjuola, 2008. Profertility effects of alchoholic extract of sesame in male sprague-dawley rats. Int. J. Nutr. Wellness, 5: 121-127.

Umapathy, E., 1993. Antifertility effects of cowpeas on male rats. Cent. Afr. J. Med., 39: 52-56.

Verma, P.K., A. Sharma, S.C. Joshi, R.S. Gupta and V.P. Dixit, 2005. Effect of isolated fractions of *Barleria prionitis* root methanolic extract on reproductive function of male rats: Preliminary study. Fitoterapia, 76: 428-432.

Yakubu, M.T., M.A. Akanji and A.T. Oladiji, 2007. Evaluation of antiandrogenic potentials of aqueous extract of *Chromolaena odoratum* (L.) K. R. leaves in male rats. Andrologia, 39: 235-243.

Yakubu, M.T., M.A. Akanji and A.T. Oladiji, 2008. Effects of oral administration of aqueous extract of *Fadogia agrestis* (Schweinf. Ex Hiern) stem on some testicular function indices of male rats. J. Ethnopharmacol., 115: 288-292.

Yama, O.E., A.A. Osinubi, F.I.O. Duru, C.C. Noronha and A.O. Okanlawon, 2011. Contraceptive effect of methanolic extract of *Momordica charantia* seed in male Sprague-Dawley rats. Asian J. Pharm. Clin. Res., 4: 22-26.

Zhuang, L.Z., Z.P. Gu and C.C. Chang, 1986. Comparison of sensitivities of rat spermatozoa, Sertoli and Leydig cells to gossypol acetic acid *in vitro* by the LD_{50}. Acta Pharmacologica Sinica, 7: 563-567.